WATER QUALITY MONITORING

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Jim Ray, Indiana DNR, Wetlands Outreach Project Coordinator
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WATER QUALITY MONITORING

GOAL: To determine the quality of the water present at the wetland.

The quality of water within a wetland is an important indicator of the overall health of the ecosystem. Monitoring and analyzing water quality data over time can provide information on positive or negative changes to the system. For example:

- A decline in water quality can result from changes in the watershed such as development or vegetation removal.
- Improvements in water quality can also result from changes in the watershed such as the planting of native grass species or reforestation.

OBJECTIVE 1: To sample and assess the water quality of a wetland through chemical means.

BACKGROUND

The quality of water in a wetland is based primarily on the surrounding watershed as well as specific features of the wetland itself. Soil type and the natural pH of the water influence the water quality and thus the vegetation growing in the wetland. Since the natural water quality of wetlands varies greatly based on the type of wetland, it is difficult to assess the quality of water by comparing it to a set standard. A more useful tool to gauge water quality in wetlands is to document and compare specific parameters over time. Many samples should be taken during the year to provide a baseline for comparison. It is important to note that most parameters in wetlands will differ from those in streams and lakes.

The following parameters are recommended for sampling. A definition for each parameter can be found in the "Definitions" section of this module.

- pH
- Water temperature
- Dissolved oxygen
- Fecal coliform bacteria
- Biochemical oxygen demand
- Nitrates
- Phosphates
- Turbidity

The general tools needed for the sampling include:

- GREEN Standard Water Monitoring Kit/Manual
- Monitoring datasheet
- Safety goggles and latex or protective gloves
- Waste container
- Stopwatch

FIELD SURVEY INSTRUCTIONS

Water quality monitoring should be conducted in July and August. For wetlands that are mostly dry during the late summer, sampling during the earlier part of the growing season is acceptable. Specific

instructions for conducting samples for each of the parameters can be found in the GREEN Standard Water Monitoring Manual. Following are general instructions for sampling:

Step 1: Choose the sampling locations

- The number of sampling locations should depend on your budget (based on the cost of the sampling kits and materials) and the size of the wetland. A minimum of two sampling locations is recommended.
- If more than one wetland habitat type is present (forested, emergent, shrubby), try to conduct at least one sample per habitat type.

Step 2: Collect the samples using the instructions provided in the GREEN Standard Water Monitoring Manual

- Collect the samples in clean containers. Isopropyl alcohol and distilled water can be used for regular cleaning of sampling containers.
- The samples should all be taken at uniform water depths, preferably a few inches below the water surface.
- DO NOT disturb the sediment or bottom surface of the wetland while collecting samples.
- Record all data collected on the monitoring datasheets.

Step 3: Discard the waste materials

- Discard the waste materials according to the instructions provided in the GREEN Standard Water Monitoring Manual.
- Be sure to thoroughly wash your hands and all sampling containers.

RECORD AND ANALYZE THE INFORMATION COLLECTED

Significant changes in the data can indicate significant changes in the watershed. Note that the sampled parameters can change seasonally and naturally over time based on water depths and recent rainfall amounts. Development of the surrounding area can increase stormwater runoff into wetlands. Conversely, planting native vegetation buffers around wetlands and their tributaries can improve water quality. If negative changes in water quality have occurred, what can be done to improve water quality or prevent further degradation?

OBJECTIVE 2: To sample and assess the water quality of a wetland through biological means.

BACKGROUND

The quality of water in a wetland can also be assessed through the sampling and identification of organisms that live in the water. The macroinvertebrate community is commonly sampled and analyzed to assess water quality. Macroinvertebrates are invertebrates (do not have a backbone) that can be seen without the aid of a microscope. They are relatively easy to collect and can be used as indicators of good or poor water quality. The tools needed to collect macroinvertebrates include:

- Dip net
- Knee-boots, hip/chest waders (depending on water depth)
- Collection pan (preferably light-colored)

FIELD SURVEY INSTRUCTIONS

Step 1: Identify habitats where macroinvertebrates are likely to be present

- Macroinvertebrates tend to be found in submerged logs, rocks, roots, leafy debris and sediment. Sampling should be concentrated in these areas.

Step 2: Sample the area with the dip net

- Sweep the net across the areas described in Step 1. An effective method is to disturb the area with your foot and then sweep the net up from under the area to capture any organisms present.
- "Wash" various objects such as submerged woody and leafy debris in the water above the net, allowing organisms in the debris to fall into the net.
- Discard the contents of each sweep into the collection pan.

RECORD AND ANALYZE THE INFORMATION COLLECTED

Identify and record the macroinvertebrates collected. Several resources are available to aid in identification of these organisms. These resources are listed in the "Resources" section of this module. Also, a general identification key is included in this module. Once identified, you can assess the tolerance to pollution of the macroinvertebrates found in your wetland. The following list is a *general* guide to pollution tolerance. More specific information can be found in the "Resources" section.

Lower Pollution Tolerance
"Winged" macroinvertebrates and larvae such as:
Damselfly nymph
Dragonfly nymph

And:
Right-handed snails

Higher Pollution Tolerance
"Wingless" macroinvertebrates and larvae such as:
Blackfly larva
Leech
Midge larva
Aquatic worms
Rat-tailed maggot

And:
Left-handed snail

Information collected can be compared to information collected in previous years if applicable. A change in the number of species tolerant or intolerant to pollution can indicate a change in water quality. A change in diversity can also indicate a change in water quality; however, some wetlands naturally have low diversity. Following is a general guide to diversity in wetlands (Mitsch and Gosselink, 1986).

Ecosystem Type	Species Diversity
Northern peatlands and bogs	Low
Inland freshwater marshes	High
Swamp forests	Low
Riparian forests	High

DEFINITIONS

Biochemical Oxygen Demand: A measure of oxygen utilized by aerobic bacteria. High levels of "BOD" indicate the presence of large amounts of organic matter and are typically associated with poor water quality.

Dissolved Oxygen: The amount of oxygen found in water. Generally, high dissolved oxygen levels means higher water quality.

Fecal Coliform Bacteria: Bacteria found in the digestive tracts of animals. The Indiana state standard for fecal coliform bacteria is 235 colonies per 100 milliliters of water, however many waterbodies in Indiana exceed this number.

Nitrates: A nutrient necessary for plant growth. Rising nitrate levels can be caused by manure and fertilizer runoff from adjacent lawns, golf courses and agricultural fields.

pH*: The "power of Hydrogen." A measure of the concentration of ions in a solution that determines whether it is acidic or basic. A pH of 1 is the most acidic, 7 is neutral and 15 is the most basic. The pH of wetlands varies naturally, however, polluted runoff can dramatically affect the pH of a wetland.

Phosphates: A nutrient necessary for plant growth. Rising phosphate levels can be caused by fertilizer and sediment runoff from adjacent lawns, golf courses and agricultural fields.

Turbidity: A measure of water clarity. Significant soil disturbance adjacent to a wetland and the subsequent runoff of that soil into a wetland can increase the turbidity.

Water Temperature*: Temperature increases over time can indicate problems in water quality.

* pH and Water Temperature naturally vary greatly in wetlands. Changes in pH and Water Temperature can affect how other substances (oxygen, heavy metals,etc.) react in water. However, for the purposes of this module, recording these parameters is sufficient.

Water Quality Survey Form

Date:_____ Time:_____ Weather Conditions:_____

Wetland Name (assign one if not already existing):_____

Wetland Location:_____
(street/reference point or latitude & longitude)

City:_____ Zip:_____ County:_____

Wetland Owner (name and address):_____

Monitor (name, address, phone/e-mail):_____

_____

Chemical Data Collection

Station 1.
Location: Wetland Type: Water Depth:

Parameter	**Value (include units)**
pH	
Water Temperature	
Dissolved Oxygen	
Biological Oxygen Demand	
Fecal Coliform	
Nitrate	
Phosphate	
Turbidity	

Notes:

Station 2.
Location: Wetland Type: Water Depth:

Parameter	**Value (include units)**
pH	
Water Temperature	
Dissolved Oxygen	
Biological Oxygen Demand	
Fecal Coliform	
Nitrate	
Phosphate	
Turbidity	

Notes:

Biological Data Collection

Station 1.
Location: Water Depth:

Macroinvertebrate Species	Number Found	Pollution Tolerance

Notes:

Station 2.
Location: Water Depth:

Macroinvertebrate Species	Number Found	Pollution Tolerance

Notes:

LIST OF RESOURCES

Books and Publications

McCafferty, W. Patrick. 1998. *Aquatic Entomology*. Jones and Bartlett Publishers, Sudbury, MA.

Hartman, Lyn and M. Burk. 2000. *Volunteer Stream Monitoring Training Manual*. IDNR, Division of Soil Conservation, Indianapolis.

Mitsch, William J. and J.G. Gosselink. 1986. *Wetlands*. Van Nostrand Reinhold, New York.

Suppliers

Earth Force Catalog
www.earthforce.org/catalog/
1908 Mount Vernon
Second Floor
Alexandria, VA 22301
ph: 703-299-9400
fax: 703-299-9485

GREEN Standard (Low-cost) Water Monitoring Kit/Manual, $29.95
Aquatic Entomology by W. Patrick McCafferty, $68.95

Other Recommended Supplies from Earth Force

Elementary Education Watershed Field Trip kit, $52.45
GREEN's Benthic Macroinvertebrate Flash Cards, $35.00

To find out more about Earth Force's GREEN (Global Rivers Environmental Education Network)

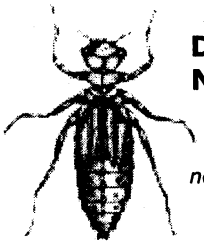
Earth Force GREEN
1908 Mount Vernon Avenue
2nd Floor
Alexandria, VA 22301
Phone: 703.299.9400
Fax: 703.299.9485
www.green.org

Aquatic Macroinvertebrate Identification Key

Lower Pollution Tolerance

3paddle-like tails

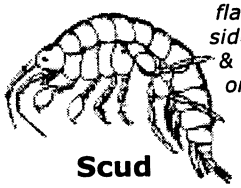
Damselfly Nymph



Dragonfly Nymph

no tails

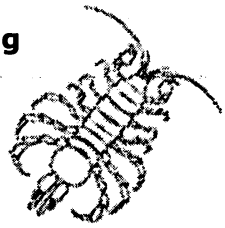
flattened side-ways & swims on side

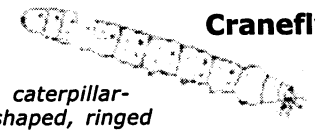


Scud

Sowbug

flattened top to bottom (looks like a pill bug)





Cranefly

caterpillar-shaped, ringed

must be alive

Right-Handed Snail

Higher Pollution Tolerance

Midge Larva

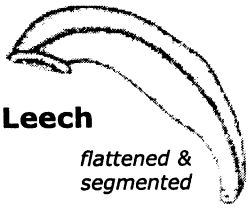
visible head & prolegs

Planaria

2 eye spots & very small

one end is swollen

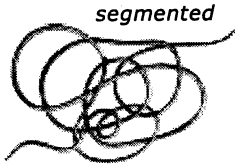
Black Fly Larva



Leech

flattened & segmented

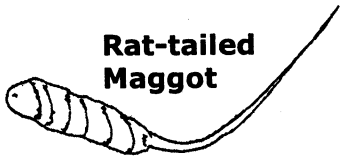
segmented



Aquatic Worms

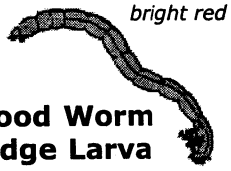
must be alive

Left-Handed Snail



Rat-tailed Maggot

bright red



Blood Worm Midge Larva